

**ROLLER-CONE BITS, SYSTEMS, DRILLING METHODS, AND
DESIGN METHODS WITH OPTIMIZATION OF TOOTH ORIENTATION**

ABSTRACT

A novel and improved roller cone drill bit and method of design are disclosed. A roller cone drill bit for drilling through subterranean formations having an upper connection for attachment to a drill string, and a plurality cutting structures rotatably mounted on arms
5 extending downward from the connection. A number of teeth are located in generally concentric rows on each cutting structure. The actual trajectory by which the teeth engage the formation is mathematically determined. A straight-line trajectory is calculated based on the actual trajectory. The teeth are positioned in the cutting structures such each tooth having a designed engagement surface is oriented perpendicular to the calculated straight-line trajectory.

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